REMARKS

This Response is submitted in response to the final Office Action mailed on January 2, 2009. No fee is due in connection with this Response. The Director is authorized to charge any fees which may be required, or to credit any overpayment to Deposit Account No. 02-1818. If such a withdrawal is made, please indicate the Attorney Docket No. 112857-402 on the account statement.

Claims 27-28, 35-36 and 39-42 are pending in this application. In the Office Action, Claims 27-28, 35-36 and 39-42 were rejected under 35 U.S.C. §112. Claims 27-28, 35-36 and 39-42 were further rejected under 35 U.S.C. §102 or, alternatively, under 35 U.S.C. §103. For at least the reasons set forth below, Applicants respectfully submit that the rejection should be withdrawn.

Independent Claims 27-28 recite, in part, a hydrogen occluding material comprising: an aluminum hydride having a formula (1) AlH_x... (1) where $0 \leq x \leq 3$; and a dopant functioning as a catalyst, wherein the dopant includes at least one species selected from the group consisting of transition metals belonging to groups III to V of the periodic table, and compounds thereof, and wherein an amount of the dopant ranges from about 0.2 mol% to about 10 mol% of an amount of the aluminum hydride, wherein the aluminum hydride has a hydrogen capacity greater than an alanate, and wherein the hydrogen occluding material is capable of releasing a greater amount of hydrogen gas in one stage at a lower temperature as compared to the alanate, and wherein the hydrogen occluding material excludes alkali metals.

In the Office Action, Claims 27-28, 35-36 and 39-42 are rejected under 35 U.S.C. §112, first paragraph, as allegedly failing to comply with the written description requirement. The Patent Office asserts that the specification does not reasonably convey to one of ordinary skill in the art that the inventors had possession of a hydrogen occluding material which excludes alkali metals as recited in Claims 27-28. See, Office Action, page 2, lines 21-22; page 3, lines 1-5. However, the Manual of Patent Examining Procedure specifically states that "[i]f alternative elements are positively recited in the specification, they may be explicitly excluded in the claims." See, MPEP §2173.05(i) (2009). The present Specification specifically describes alanates of the formula $XAlH_4$, where X=Na, Li, and the like and contrasts those compounds with the isolated AlH_3 hydrides of the present claims. See, Specification, page 1, paragraphs 9-11 and 18; page 2, paragraph 19, lines 1-5. In fact, Figure 1 compares the amount of hydrogen released by a hydride of the present claims, AlH_3, with the amount of hydrogen released by a

hydride containing the alkali metal sodium. See, Specification, page 2, paragraph 23; page 3, paragraph 54; Fig. 1. Therefore, Applicants respectfully submit that the present Specification recites alternative hydrides: those including alkali metals and those excluding alkali metals such as sodium.

Furthermore, regarding the overall hydrogen occluding material containing alkali metals, the present Specification recites alternative embodiments of the material which contain AlH_3 and Ti (Example 3) and AlH_3, Ti and NaH (Example 4). See, Specification, page 4, paragraphs 63 and 65. The Specification notes that an additional peak of hydrogen results from NaH and, thus, the material of Example 4 does not exhibit a lower hydrogen release temperature than the material of Example 3. See, Specification, page 4, paragraph 66, lines 5-10; Figs. 4-5. The Specification then expressly recites the use of Ti and NaH as alternative dopants for the claimed material. See, Specification, page 4, paragraph 72. Applicants respectfully submit that the recitation of alternative dopants, one which contains an alkali metal and the other which includes merely titanium, provides support for the exclusion of alkali metals from the dopant. As discussed previously, the Specification also provides adequate support for the exclusion of alkali metals from the hydride. Therefore, the Specification provides adequate support for the exclusion of alkali metals from the entire hydrogen occluding material. As such, the subject matter of Claims 27-28 is adequately described by the Specification.

Accordingly, Applicants respectfully request that the rejection of Claims 27-28, 35-36 and 39-42 under 35 U.S.C. §112, first paragraph, be withdrawn.

In the Office Action, Claims 27-28, 35-36 and 39-42 were rejected under 35 U.S.C. §102(e) as being anticipated by, or alternatively, under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,773,692 B2 to Pecharsky et al. ("*Pecharsky*"). Applicants respectfully submit that the *Pecharsky* fails to disclose or suggest each and every element of independent Claims 27-28 and Claims 35-36 and 39-42 that depend therefrom for at least the reasons set forth below..

Conventional hydrogen occluding materials include alanates such as $NaAlH_4$ and $LiAlH_4$. See, Specification, page 1, paragraphs 7 and 10. However, thermal decomposition of such alanates occurs in two stages and only releases approximately 5.5 weight % hydrogen. See, Specification, page 1, paragraphs 9-10; paragraph 11, lines 1-4. Therefore, the present claims provide an improved hydrogen occluding material comprising an aluminum hydride and a dopant. See, Specification, page 2, paragraphs 19-20; Fig. 4. Unlike alanates, isolated

aluminum hydride thermally decomposes in one stage. See, Specification, page 1, paragraphs 17-18; page 2, paragraph 19. Furthermore, by including the dopant, the hydrogen occluding material of the present claims releases more hydrogen and at a lower temperature than the hydride alone. See, Specification, page 2, paragraphs 31-35; Fig. 3. In contrast, *Pecharsky* fails to disclose or suggest every element of the present claims for at least the reasons set forth below.

For example, *Pecharsky* fails to disclose or suggest a dopant functioning as a catalyst, wherein the dopant includes at least one species selected from the group consisting of transition metals belonging to groups III to V of the periodic table, and compounds thereof as required, in part, by independent Claims 27-28. The Patent Office asserts that *Pecharsky* teaches the use of a catalyst selected from metals belonging to periods III to V of the periodic table. See, Office Action, page 4, lines 10-12. However, *Pecharsky* merely discloses processing its solid hydride in the presence of a catalyst. See, *Pecharsky*, column 4, lines 42-44. The present claims recite a dopant which functions as a catalyst, not merely a catalyst. When describing the dopant of the hydrogen occluding material, the Specification expressly states that the dopant (titanium in Example 3) "exists on the surface of the AlH_3 so as to promote decomposition into hydrogen." See, Specification, page 4, paragraph 61, lines 4-7. Nowhere does *Pecharsky* refer to its catalyst as a "dopant," nor does it suggest that the catalyst is deposited on the surface of its hydride.

The manner in which *Pecharsky* utilizes the catalyst with its hydride further suggests that the catalyst is not a "dopant." *Pecharsky* teaches supplying a reaction mixture containing the catalyst and the hydride to a milling apparatus such as a ball-mill and extracting the hydrogen from the ball-mill apparatus. See, *Pecharsky*, column 5, lines 29-34 and 54-67. In contrast, the Specification teaches that "doping [is] accomplished by mixing [the catalyst and the hydride] (in powder form) in an agate mortar for about 5 minutes." See, Specification, page 4, paragraph 61, lines 4-7. The Specification expressly contrasts this doping process with ball-milling. See, Specification, page 4, paragraph 64, lines 1-4; paragraph 65, lines 1-3. Moreover, even if ball milling could be equated with mixing in an agate mortar, the ball-milling simultaneously releases hydrogen from the hydride. See, *Pecharsky*, Abstract, lines 1-7; column 3, lines 65-67; column 4, lines 1-10; column 5, lines 54-67; column 6, lines 1-5. As such, the resulting catalyst-hydride mixture would not contain as much hydrogen as the material of the present claims. See, Specification, page 4, paragraphs 64-66. Therefore, *Pecharsky* fails to disclose a hydrogen occluding material containing a dopant functioning as a catalyst, wherein the dopant includes at

least one species selected from the group consisting of transition metals belonging to groups III to V of the periodic table, and compounds thereof in accordance with the present claims.

Pecharsky also fails to disclose or suggest a hydrogen occluding material comprising: an aluminum hydride having a formula (1) AlH_x... (1) where $0 \leq x \leq 3$, wherein the hydrogen occluding material excludes alkali metals as required, in part, by independent Claims 27-28. The Patent Office argues that this claim element is satisfied merely because *Pecharsky* teaches a hydride that does not contain alkali metals. See, Office Action, page 4, lines 16-18. However, the claims do not recite merely that the hydride excludes alkali metals but rather that the entire hydrogen occluding material, including the hydride and the dopant, excludes alkali metals. The Specification teaches using titanium as the sole dopant and isolated AlH_3 as the hydride to achieve a lower release temperature for the hydrogen. See, Specification, page 4, paragraphs 61-63; Fig. 4. In contrast, every experimental example in *Pecharsky* teaches using an alkali metal in the hydride-catalyst mixture. See, *Pecharsky*, column 7, lines 49-51; column 8, lines 42-44; column 9, lines 17-19 and 59-61. Nowhere does *Pecharsky* disclose or suggest a hydrogen occluding material which excludes alkali metals.

Instead, the portion of *Pecharsky* relied on by the Patent Office merely discloses that the hydride may not contain an alkali metal. See, *Pecharsky*, column 4, lines 21-24. *Pecharsky* further states that the catalyst may be "any catalyst that is useful to liberate hydrogen from a solid hydride being subjected to mechanical processing can be used." See, *Pecharsky*, column 4, lines 44-46. The present Specification teaches that NaH is one catalyst that may be used to liberate hydrogen from a solid hydride. See, Specification, page 4, paragraph 72. Therefore, even if the hydride of *Pecharsky* does not contain an alkali metal, an alkali metal may be used as the catalyst in *Pecharsky* to create a hydrogen occluding material which contains an alkali metal. *Pecharsky* does not disclose that if AlH_3 is used as the hydride, the dopant excludes alkali metals. In fact, every example disclosed in *Pecharsky* includes an alkali metal. As such, nowhere does *Pecharsky* disclose or suggest a hydrogen occluding material which excludes alkali metals as required, in part, by the present claims.

Moreover, every experimental example disclosed in *Pecharsky* is directed to an alanate (e.g., $XAlH_4$) in contrast to the aluminum hydride (e.g., AlH_3)of the present claims. See, *Pecharsky*, column 7, lines 49-51; column 8, lines 42-44; column 9, lines 17-19 and 59-61. Indeed, Applicants have demonstrated that the claimed occluding material including an aluminum hydride, such as AlH_3 as further defined by dependent Claims 41-42, exhibits

enhanced hydrogen occluding properties over conventional hydrides such as alanates, particularly when the material includes a dopant and excludes alkali metals as further claimed. See, Specification, page 1, paragraph 12, lines 2-7; page 2, paragraph 19, lines 1-5; paragraph 23; page 3, paragraph 54; page 4, paragraph 66, lines 5-10; Figs. 1 and 4-5. For example, an aluminum hydride of the present claims thermally decomposes and therefore releases hydrogen in one stage, whereas alanates release hydrogen in two stages. See, Specification, page 1, paragraph 11, lines 1-4; page 2, paragraph 19, lines 1-3. In addition, the aluminum hydride of the present claims releases a greater amount of hydrogen, nearly 10 weight %, than alanates, which typically release only 5.6 weight % hydrogen. See, Specification, page 1, paragraph 11, lines 1-4; page 2, paragraph 19, lines 3-5. *Pecharsky* merely discloses releasing between 4.7 and 5.2 weight % hydrogen. See, *Pecharsky*, column 8, lines 35-38; column 9, lines 9-13 and 52-55; column 10, lines 36-40. As such, Applicants respectfully submit that, contrary to the Patent Office's assertion, see, Office Action, page 4, lines 19-21, the materials of *Pecharsky* do not inherently exhibit the same hydrogen capacity as the claimed materials, let alone render the claimed materials obvious.

Accordingly, Applicants respectfully request that the rejection of Claims 27-28, 35-36 and 39-42 35 U.S.C. §102(b) or, alternatively, under 35 U.S.C. §103(a) to *Pecharsky* be reconsidered and withdrawn.

For the foregoing reasons, Applicants respectfully submit that the present application is in condition for allowance and earnestly solicits reconsideration of same.

Respectfully submitted,

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